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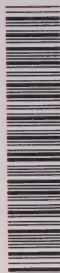
Impacts of Water Supply and Sanitation in Three Rural
Guatemalan Communities.

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IMPACTS OF WATER SUPPLY AND SANITATION IN THREE RURAL GUATEMALAN COMMUNITIES

by

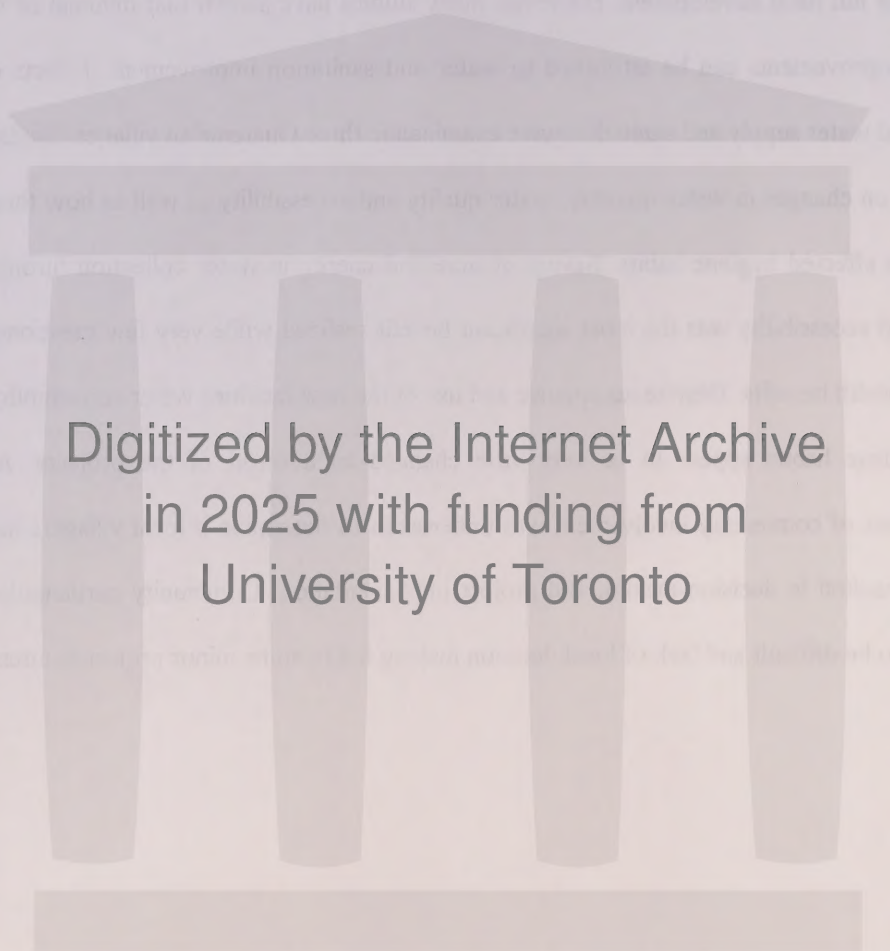
Ross Glenfield

A research paper submitted in conformity with the requirements
for the degree of Master of Arts
Graduate Department of Geography
University of Toronto

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Abstract

Water supply and sanitation development are often felt to be the critical services to achieving full rural development. However, many studies have shown that minimal or no health improvements can be attributed to water and sanitation improvement. Effects of improved water supply and sanitation were examined in three Guatemalan villages. Studies focused on changes in water quantity, water quality and accessibility as well as how these variables affected hygiene habits. Saving of time and energy in water collection through improved accessibility was the most significant benefit realized while very few mentioned related health benefits. Despite acceptance and use of the new facilities water consumption and hygiene habits appear to be very little changed as a result of the projects. An assessment of community involvement was undertaken to determine if local villagers had been consulted in decision-making and project implementation. Community participation proved to be difficult and lack of local decision making led to some minor project failures.



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To the people of Yalambojoch, Yulaurel and Santa Elena who allowed me into their homes and shared their experiences with me and without whom this project would not be possible. Thank you.

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1. INTRODUCTION

1.1 The International Drinking Water Supply and Sanitation Decade

When he addressed the World Bank's Board of Governors in 1980, President Robert S. McNamara stated that to achieve economic growth and eradicate absolute poverty access to essential public services was required (Kalbermatten et al. 1982). As water is the basis of all life, provision of clean water is a key factor in social and economic development for both individuals and communities. Therefore, implementation of potable water systems and accompanying sanitation systems are important areas in which to focus development work (Lauria 1994). Access to clean water and sanitation are often assumed to be "first steps" in development as water and sanitation affect virtually every facet of life in rural villages. Improvements in both quality and quantity of water and proper sanitation systems will have ramifications in the areas of health, women's empowerment and general quality of life.

Recognizing the critical role of accessible clean water and sanitation in development for the world's poor, the United Nations declared the period 1981-1990 as the International Drinking Water Supply and Sanitation Decade (IDWSSD). The lofty goal of the Decade "to provide access to safe water and sanitation for all" would require services for an additional 2.2 billion people mainly in rural areas (Roundy 1985). Despite the advancements made during this time new services were just able to keep up with population growth. With the Decade past, 1991 figures show that 1.3 billion people are without access to safe water and 2 billion are without access to sanitation (UNDP 1993).

Another concerted effort to supply the world's poor with clean water and sanitation will be needed as the World Bank in its World Development Report (1992) declared water and sanitation to be the single most important factors in development.

1.2 Health and social development from water supply and sanitation

The World Health Organization (WHO) has stated that for small towns and rural villages “more health benefits can be gained from money spent on a water supply program than in any other way” (Hunt 1988). Lack of clean-water access most severely affects children. In poor countries diarrheal disease, perpetuated by unclean water, is the number one killer accounting for greater than 3 million deaths annually, mainly children, and causes approximately 900 million episodes of illness (World Bank 1992). Briscoe (1984) shows the positive effects clean water and sanitation can have in the reduction of the incidence of diarrhea (Table 1). Diseases such as cholera and typhoid are transmitted through contaminated water and can therefore also be reduced by improvement of the water source.

Improved health through water supply and sanitation improvement can contribute to economic growth. Health improvements allow workers to increase their productivity, allow children to participate more effectively in school and can increase school enrollment. Resources can also be liberated that would previously be required to treat illnesses (World Bank 1993).

When implementing new water supply programs priorities should be given to technologies that reduce the time women and children spend fetching water (Bell and

Franceys 1995). Women are often required to walk great distances to collect water and are therefore only able to carry small quantities. In a study of a typical developing-country woman's daily schedule Feachem (1978) found that often over 10% of the working day was devoted to collecting water. It has been found that quantities of water used remain low, approximately 15-30L per person per day, if water must be collected from a distance (World Bank 1992). Only when water availability rises to greater than 50L per person per day is water able to be used for personal hygiene.

Table 1. The effects of water supply and sanitation programs on diarrheal diseases.

Parameter Affected	Number of Studies	Per Cent Reduction in Diarrheal Diseases (median)
Water quality	6	30
Water availability through standpipes	11	34
Quality and availability	4	40
Excreta disposal	8	40

Source: Briscoe 1984, p. 1010

Despite the claims of the positive effects of improved water systems on health Esrey and Habicht (1986) found that only 16 of 33 studies reported positive health impacts with improved water quality and quantity. Many investigations during the IDWSSD indicate that access to safe water had a small impact, much smaller than impacts from improved sanitation and improved hygiene practices (IDRC 1995). Additionally Bridger and Winpenny (1987) support the idea that studies show little or no health

improvements can be attributed to improved water supply in villages. In fact they suggest that increased water use could have an adverse effect by enhancing the spread of water-borne diseases. It is only where favourable conditions exist, such as community awareness of problems and adequate hygiene practices, will improved water supply be able to make positive contributions to improving health.

1.3 Objectives of this study

With the divergent views on the effects of water supply and sanitation the purpose of this study is to focus on some of the effects of water supply and latrines in three rural villages in northwestern Guatemala. In addition, a discussion of hygiene will be undertaken to analyze if conditions exist within the villages to allow for the realization of health improvements. Specific health benefits will not be discussed in this paper. Finally, comment will be made on the extent to which the communities have been involved in the decision making process of project development in their villages.

2. RECENT SOCIAL AND POLITICAL HISTORY OF GUATEMALA

2.1 Socio-cultural and economic problems of western Guatemala

Guatemala, with over 10 million people, is the most populous country in Central America (figure 1) and is unique in the region as indigenous Mayan Indians comprise over half the population. This indigenous population is composed of 28 distinctive language groups and has largely been marginalized to the less fertile western highlands where they comprise over 95% of the population in the departments of Sololá, Huehuetenango, and El Quiché. As most are subsistence farmers, the population has not been integrated into the economic and political processes of the country (Torres-Rivas 1989). Clear divisions exist between the Indians and those of Spanish descent. Former vice-president Francisco Villagrán Kramer (1992:7) lays much of the blame on governments as they have supported “a structure where since colonial times 40% of the inhabitants have oppressed - culturally, socially and politically the other 60%”.

The political forces that shape modern Guatemala have their beginnings after the forced resignation of President Jorge Ubico in 1944. The next decade would see successive democratically elected governments hold office and would later come to be known as the “ten years of spring”. During this period social and economic reforms were undertaken to reduce oppression of the rural peasants and urban working class. Reforms undertaken by the Arévalo government focused on public health promotion, rural education and social security (Barry 1990). The subsequent Arbenz regime attempted to tackle the most pressing national problem of land reform. The Agrarian Reform Law of

1952, which aimed to expropriate unused or under-utilized lands and redistribute them to landless peasants, pitted the administration against large landholders such as the United States United Fruit Company. As the country's largest landowner, the United Fruit Company, with over 555 000 acres - of which 85% was uncultivated, was to have 387 000 acres expropriated and receive reimbursements based on its own under-declared tax value of the land (McClintock 1985). This shift in economic power to rural workers and away from large landholders was an affront to many foreign-owned businesses and the Catholic Church. This economic threat to United States' interests as well as Arbenz's allowance of the communist party initiated a CIA misinformation campaign and covert actions aimed at destabilizing the administration (Booth and Walker 1993). In June 1954 the small CIA-supported National Liberation Army (MLN), with the assistance of US air power, forced Arbenz to resign. Colonel Carlos Castillo Armas, head of the MLN, was later brought to Guatemala City in the US Ambassador's Embassy plane to assume the presidency and ushered in a period of military dictatorships that have been a hallmark of life in Guatemala.

The extreme right-wing government of Castillo Armas negated virtually all the social and political advances made by the rural peasants and urban poor during the previous decade. Literacy programs were halted, labour unions disbanded and the Agrarian Reform Law was repealed returning the expropriated land to the previous owners (McClintock 1984). Land distribution remains the dominant social problem facing Guatemala. In a region fraught with land ownership inequities Guatemala has the most severe imbalance as 2% of the population owns 65% of the land (Jonas 1991). Some estimates state that the wealthiest 2% of the population own as much as 80% of the land

(Blouet and Blouet 1993). The Gini Index for land distribution was found to be worse than for pre-reform Nicaragua and El Salvador (Hough 1982). Most alarming is the trend that the imbalance is becoming more severe, (the USAID report found the Gini Index increasing in 16 of Guatemala's 22 departments) and the size of the small hillside plots farmed by rural peasants has decreased from 0.37ha to 0.23ha from 1964 to 1979 (Torres-Rivas 1984). As approximately one-third of families are unable to support themselves on their land, many highland Indian families are required to travel to the south coast for seasonal work on the large coffee and fruit farms. Since the 1950s Indians from the highlands have colonized the northern region of Huehuetenango, El Quiché and Alta Verapaz in an attempt to alleviate population and land pressures. In the 1960s the government officially designated many of these areas for colonization and peasants were able to clear unclaimed government-owned jungle lands.

2.2 Violent conflict since the 1960s

The rise of right-wing death squad activities in the late 1960s as well as the social and economic inequalities spawned the organization of guerrilla insurgency groups in the western highlands and northern jungles of the Petén. Four major groups operated throughout the country with the Ejército Guerrillero de los Pobres (EGP) (the Guerrilla Army for the Poor), operating in the departments of El Quiché and Huehuetenango with widespread popular support from the Indian peasantry.

Urban repression reached its zenith under the regime of Romeo Lucas García between 1978 and 1982. Political opponents, union activists, academics and student

leaders in the capital were regularly murdered by army troops and the national police. Directions for the murders were identified as coming from an annex of the National Palace (Simon 1987). Also at this time the army was establishing posts in most rural Indian villages and massacres were common. During the Lucas García regime an estimated 25 000 people were killed including 11 000 in 1981 alone (Barry 1991). This violent repression led to a strengthening of support for the guerrilla forces and numbers swelled to 6000 armed combatants and 250 000 unarmed supporters.

Following fraudulent elections in March 1982 in which Lucas García's hand-picked successor was victorious, a coup d'état and a series of subsequent juntas placed General José Efraín Ríos Montt in the presidency assisted by two high ranking military personnel. Ríos Montt, a graduate of special training in "counterguerrilla operations" at US Army bases in the Panama Canal zone and in North Carolina promised to rid the western highlands of guerrilla insurgents in a fast and efficient manner (McClintock 1985). While death squad activity and extra-judicial killings dropped dramatically in the capital immediately following the coup, prompting US Ambassador Frederic Chapin to proclaim "the killings have stopped" and that the Guatemalan government had "come out of the darkness and into the light", rural repression was reaching new levels (Simon 1987:110). The army began carrying out a scorched-earth campaign, similar to those carried out in Vietnam, throughout the highlands and it was felt that in the first month and a half after the coup that over 3000 were killed. Massacres involving dozens of victims were common in Chimaltenango, Baja and Alta Verapaz, El Quiché and Huehuetenango. One of the most reliably documented massacres occurred at San Francisco Nentón, Huehuetenango on July

17, 1982 where 352 men, women and children were massacred (Cultural Survival 1983). As a result of this event and others like it, priest and anthropologist Ricardo Falla charged the Ríos Montt regime with genocide as defined by the United Nations General Assembly because "it has perpetrated killings of [an] ethnic group with the intent of destroying [it] completely" citing the slaughter of children not yet old enough to reason (Permanent People's Tribunal 1984:112). This event served as the impetus for a massive migration of people from the northern Huehuetenango region to Mexico.

The Ríos Montt regime was toppled by a coup and the subsequent administration of Mejía Víctores later held democratic elections in 1985. Most people in Guatemala have little faith in the democratic process as the army retains much of the power. Voter turn out was poor in 1985 with less than 50% casting ballots and violence carried on unabated (National Academy of Sciences 1992). Shortly after the election of Jorge Serrano Elías in 1991 negotiations between the government and the guerrilla insurgents (URNG) began in Mexico City. Progress has been slow and the date for a firm and lasting peace originally anticipated in 1994 has been revised (United Nations 1995). Massacres continue to occur as evidenced by the recent killings in Xamán, Alta Verapaz in October 1995 (Rohter 1995a). Democracy remains weak as less than 40% voted in the November 1995 elections and no clear victor from the 19 parties was declared (Rohter 1995b). The 1995 elections are noteworthy as General Ríos Montt was the leading candidate for President until July when he was constitutionally-barred from running for office. Still he is felt to be the power behind the Frente Republicano Guatemalteco (FRG) which is scheduled to participate in runoff elections in January 1996 (Rohter 1995c).

Guatemala's recent political and military history has not been conducive to achieving adequate national social and economic development. The country's development in these respects is among the worst in Latin America. Many within the country as well as those refugees remaining in Mexico lack faith in the government and many social organizations have been met with repression (Lykes 1994). The result of this instability has been the perpetuity of underdevelopment, most acute in the rural regions of the western highlands. The United Nations (1993) states that 74% of the rural population lives in absolute poverty and despite the efforts of the IDWSSD only 41% in rural areas have access to potable water and 52% have access to sanitation, lower levels than other Central American countries (World Bank 1994). An International Development Research Centre (IDRC) article paints a much darker picture stating that only one village in ten has a latrine or safe water supply (Hunt 1988). Heggenhougen (1984), speaking about the effectiveness of primary health care in Guatemala, notes that to improve the situation of communities basic changes are required in the social and economic situation of population groups and that these changes are related to social justice and equal access to resources.

2.3 Location and description of the communities studied

The present study was undertaken with the assistance of Centre Canadien d'Étude et de Coopération Internationale (CECI) between May 23 and July 3, 1995 in the villages of Yalambojoch, Yulaurel and Santa Elena in the Municipality of Nentón, Department of Huehuetenango, Guatemala (figure 2). All three villages were abandoned in 1982 due to nearby violence and the massacre at San Francisco. Both Yalambojoch and Yulaurel are

indigenous Mayan villages whereas Santa Elena has a ladino (those of mixed Indian and Spanish ancestry) population. Chuj is the main language spoken in Yalambojoch and Yulaurel. Most however are conversant in Spanish presumably from the time spent in Mexico. Those in Santa Elena speak Spanish. Yalambojoch, with 136 families, is the largest of the villages studied and the only one that has road access. Some in the village returned within one to two years after abandoning the village while a group of 71 families returned in January 1994 (CECI a. unpublished). The other two villages are much smaller - Yulaurel has 18 families, children and relatives of those killed in San Francisco, and Santa Elena 14. Both Yulaurel and Santa Elena remained uninhabited between 1982 and 1992. These latter villages remain without road access. Approximately 3.5 hours is required to access each over rough trails from Guatemalan roads. Access is much easier , both in distance and time, from the Mexican side of the border.

Figure 2. Northern region of Huehuetenango and study sites

3. RESEARCH QUESTIONS AND METHODOLOGY

3.1 *The basic hypothesis*

Provision of improved water supply and sanitation facilities in the three communities is based on the principle that:

$$\text{hygiene habits} + \text{water} + \text{sanitation (latrines)} = \text{health}$$

and the corollary:

$$\text{health} = \text{a better standard of living for the family (CECI f. unpublished)}$$

Assessment of each of the 3 variables, in the equation to better health, will be made and their effects on the villages will be noted.

3.2 *Research questions*

The research questions posed in this study aim to examine the effects of recently installed water supply and sanitation systems in three rural Guatemalan communities as well as determine if community members have been involved in decision-making. Surveys conducted by the World Bank in east and west Africa have shown that only one-third of intended beneficiaries from improved rural water systems actually use the new systems (World Bank 1987). Therefore the study focuses on answering the following questions. First, are the new water sources and latrines preferable to the other existing facilities and do the village populations use the new installations for gathering water and sanitation respectively? Secondly, has water supply and sanitation had positive effects on hygiene

habits? Lastly, to what extent has a community-based approach been used in the provision and establishment of the water supply and sanitation projects? These questions have been posed to determine if the new systems implemented are having positive effects, and are responsive to the desires of the villagers, so as to attain the ultimate goal of improving health. The questions are pertinent as many new water supply and sanitation facilities will be implemented in the rural border areas of Guatemala as repatriation of refugees from Mexico continues.

3.3 Methodology

In an attempt to answer the aforementioned research questions different variables have been considered for each. To determine if the new water and sanitation systems are “preferable” to the old sources water quantity consumed was measured, water quality was examined and water accessibility and seasonal water reliability were assessed. Where possible, comparisons were made between the old and new sources with respect to these variables. The use of latrines will also be discussed. Effects of water supply and sanitation on the hygiene habits within the village populations were based on observations of handwashing and water handling. Kitchen cleanliness and garbage disposal were also considered when assessing the overall hygiene habits of the residents. The community-based approach was evaluated by considering the involvement of local residents in contributing to the project development, the degree to which they were involved in the decision-making processes, and their sharing in the benefits of the program.

Working within temporal and financial constraints a qualitative approach was selected for the resolution of the research questions. A combination of techniques was employed to gather data. Simpson-Hebert (1983) suggests that where these constraints are encountered participant observation, key-informant interviewing and heuristic elicitation techniques should be given priority. Participant observation was chosen in an attempt to develop a rapport with the community members. In each community I lived with a family to better understand, and participate in, daily activities. Key informants such as members of the development committees, teachers and community health promoters, where they existed, were interviewed. Originally topic-focused interviews were to be conducted with a number of general respondents in each of the three villages. However very little enthusiasm for the study was noted in the Chuj villages, many of the respondents were distrustful of the interviewer and reluctant to discuss their water supply and sanitation situations. Goldman and Pebley (1994) noted a similar experience in a health-based study and cited this as a "major difficulty in data collection". Due to this difficulty the technique of topic-focused interviews was abandoned in favour of open-ended interviews. Open-ended interviews allowed for heuristic elicitation, where questions were based on previous answers, and in this way allowed the conversation to be generated by the respondents. To initiate interviews a different method was chosen for each village. In Yalambojoch, due to its larger size, I sat in the central park area and waited for people to approach me before beginning an interview and later I went to the house for observations. In Santa Elena I was fortunate to have a local villager accompany me and introduce me to fellow villagers, this allowed for easier and superior access to village residents. Yulaurel, with its small size and

concentrated housing settlement, allowed for household visits to be undertaken after a conversation was initiated outside the homes. Both men and women and occasionally children were interviewed for the study. Sixteen people were interviewed in Yalambojoch, 15 in Santa Elena and 9 in Yulaurel. The open-ended interview process made it difficult to compare respondents answers and therefore a standardized survey was not conducted. Small sample sizes suggested a qualitative approach was more applicable than a statistical analysis.

Specific measurements of water quantity were calculated by measuring the collection vessels used by those fetching water. Most vessels were standard 15 and 20L jugs, called “tinajas”, which women use to carry water. No quantitative water quality studies could be obtained for the villages so a purely physical assessment of the water sources was made. Physical water quality was based on taste, smell, colour, turbidity, hardness and temperature. Water accessibility was measured in time and distance to the water source and comment will be made about the terrain over which the water gatherers travel for collection. Guatemala has a distinct wet and dry season with the rains usually beginning in May and lasting until November. Discussions were conducted with villagers about the reliability of the water sources in the different seasons. Hygiene habits were assessed by noting if handwashing was performed after use of the latrines, before cooking and before eating. In-house water handling considered both how and where water was stored and also observations of possible water-contamination incidents were noted. Kitchen cleanliness was assessed on the storage practices of plates and cutlery, acceptance of animals within the kitchen and garbage disposal. In determining community

participation consideration was given to the extent to which villagers were involved in decision-making and at what stages of the projects. This was done by comparing what CECI had outlined in their project literature with comments of community involvement as perceived by village residents.

Previous personal visits to the western highlands of Guatemala include three trips in the dry seasons of 1992, 1993 and 1994. These trips served to assist with an understanding of conditions within the country. This study coincided with the end of the dry season and the beginning of the rains.

4. DESCRIPTION OF THE DEVELOPMENT PROJECTS

4.1 *Proyectos de Impacto Rapido (PIR)*

To address many of the basic needs of those refugees returning from Mexico the United Nations is working in conjunction with many national and international non-governmental organizations for provision of services. The program of "Proyectos de Impacto Rápido" (PIR), Rapid Impact Projects, is conducted by the United Nations High Commissioner for Refugees (UNHCR) and administered in the area of study by Centre Canadien d'Étude et de Coopération Internationale. The PIR do not aim to be a large-scale "classic" development projects but are rather an intermediate level between those large-scale development projects and emergency assistance. As such project expenditures must be modest, less than Q. 600 000 (approx. US\$100 000) and be functional within one year (CECI b. unpublished). Focus of the PIR are in the areas of health, potable water supply, sanitation, home improvement, education, and small business support among others. Intended beneficiaries are rural communities, located in the northwestern departments bordering Mexico, that have a large number of repatriated refugees. Projects address necessities identified by the beneficiaries and are enacted upon acceptance, by CECI, of a proposal from community organizations, non-governmental organizations, churches and businesses (CECI b. unpublished). The Rapid Impact Projects in the area of study focused on water supply and sanitation. The projects were implemented between March 1994 and January 1995.

4.2 Water supply systems

Two different water supply systems have been chosen to service the three communities. Gravity-fed systems are used in both Yalambojoch and Yulaurel. Water is collected from springs high in the mountains and stored in tanks located approximately 30m above the village to maintain water pressure. Each home in these villages is supplied with a tap located between 2m and 10m from the house (figure 3). The first taps constructed in Yalambojoch have cement pedestals whereas the more recent taps consist of only a plain pipe. Simple pipes were also installed in Yulaurel and residents there have made modifications to improve the taps for their needs. Drainage pits have been dug and large cobbles placed within the holes to reduce mud around the entrance to the houses. A 15cm plastic tube has been placed on the end of most household taps to reduce spray and concentrate the water in a single stream. Women in the community use extra pieces of sheet metal for roofing as a trough by which water flows to their wash basins. To avoid having animals rubbing directly on the tap pipes villagers have supported the pipes with wooden braces.

The village of Santa Elena has been provided with two community groundwater pumps one located in the center of the scattered houses and the second at the periphery. The Guatemalan-made “Maya” brand pumps sit on a cement well cover that has a collection trough to drain excess water from the immediate pump area (figure 4). Sheet-metal roofs cover the pumps. The pump located in the center of the village had been non-functional for 5 weeks prior to, and remained inoperable at the time of, my visit. This was due to a broken part, damaged during maintenance by the local villagers.

4.3 Latrines

Two different latrine systems have been implemented in the communities. Simple unventilated pit latrines (figure 5) have been instituted in Yalambojoch and Yulaurel. Since the water is not drawn from the groundwater table the pits will not contaminate the local water supply. As the villages are quite isolated the threat to neighbouring villages' water supply is minimal. The latrines consist of an unlined pit 2-3m in depth covered with a 1.2m x 1.2m cement floor and a cement pedestal approximately 40cm high. These latrines replace older versions with wooden floors and seats.

Where the groundwater table is high, within 300cm of the surface, it is recommended that latrines be built above ground (Mara 1984). Santa Elena has received composting latrines (letrina abonera)(figure 6) that sit above ground thus they do not affect the village's groundwater source. The composting toilets are dry latrines that have two collection compartments. Excreta collects in the compartment while a small urinal at the front of the seat is drained via a plastic tube to a collection jug which is then used for watering plants. When one compartment is full it is left to compost for 6-8 months while the other side is used. To aid in the composting process residents are required to sprinkle ash from the kitchen fire in the latrine every few days. Compost is to be used as fertilizer for shrubs and plants. Latrine coverage for all three villages is 100% of the households.

Figure 3. Household water taps used in Yalambojoch and Yulaurel



Figure 4. "Maya" brand pump used in Santa Elena



Figure 4. Simple pit latrine in Yalambojoch



Figure 6. Composting latrine (letrina abonera) in Santa Elena



5. RESULTS AND DISCUSSION

5.1 Water supply indicators

5.1.1 Water quantity

Clean water is often felt to be the key variable in the equation for better health as it is believed to have effects on both hygiene and sanitation. Quantity of water supplied should not be forsaken in an attempt to reach stringent water quality standards of developed countries. Many studies show that water quantity often has a greater impact on improving than improved water quality (Esrey et al. 1985)(Briscoe 1984). Water quantity is important inasmuch as it can encourage washing and cleaning and reduce water-washed diseases, such as infections of the skin and eyes, provided the increased supply is used. The absence of abundant water inhibits personal hygiene and the cleanliness of clothes and kitchen utensils.

In Yalambojoch and Yulaurel the communities now exclusively use the household taps provided and residents stated that they are an improvement over their previous water sources. Prior to the provision of water through household connections, residents of Yalambojoch relied on three community taps while those in Yulaurel gathered water from a nearby stream. In these villages water from the household taps is used for both cooking and cleaning as well as bathing. Only one instance of water being used for watering plants was noted as the person was responsible for tending seedlings for another development project. Since the water taps are unmetered exact quantities of water consumed were unable to be determined. However, most water used for cooking and cleaning was taken

from the tap and then stored in 15 and 20L “tinajas” in the house. Hence estimates of water quantity were made by observing and asking how many tinajas women used in a day. Most respondents in Yalambojoch said they use approximately 8-15L tinajas for an average family size of 6 persons. This yielded an average use of 20L of water per person daily (Lpppd). The range in consumption varied from 4 to 10-15L tinajas. Only minimal amounts of rain water were collected. Interviews and in-home observations were conducted with six families in Yalambojoch.

In Yalambojoch the five days prior to my visit the water tank had been dry and women were gathering water from Rio Sachilá between the village and San Francisco (figure 2). For most women in the village this represented a 30-60 minute round trip for water over a distance of 1-2km. The subsequent increase in effort to collect water resulted in the villagers decreasing their water consumption. When water had to be collected from a distance its use was curtailed and used only for cooking and limited cleaning. Women mentioned that they collected between 2 (20L) and 6 (15L) tinajas of water, for a range of 40-90L, when gathering water from the river. They cited both increased time and effort as the reason for less consumption. The family that collected only 2-20L tinajas said that they would have collected more if they had an animal to carry the water. When collecting water from the river residents reduced their consumption to between 10 and 15Lpppd.

Women in Yulaurel tended to use 20L tinajas more frequently and would fill between 5 and 7 tinajas daily. Families interviewed in Yulaurel were on average one person larger than those in Yalambojoch and contained many young children. Daily per

capita water consumption was slightly less, averaging 15-20L. These figures are based on four families with whom interviews and in-home observations were made.

In Santa Elena observations and questions regarding water use practices were asked of nine families. Since one pump was not operational at least 6 of the 14 families (from 5 different houses) collected water from a small stream running through the village. The remaining households either collected water from the pump or were not questioned about their water collection habits. There appeared to be no difference in the daily per capita consumption between families gathering water from the stream versus those collecting from the pump. Families collected between 4 and 8-15L tinajas. With an average family size of 5.3 persons per capita consumption was 17L.

A recent IDRC (1995 unpublished) study conducted in Guatemala's altiplano, further to the south, found houses with piped water use approximately 35L per person per day exclusive of clothes washing whereas houses lacking home connections consume less than 14Lpppd. Where access to water is greatly inhibited consumption levels have reached levels as low as 8.8Lpppd as noted by Gilman (1993) in Peru. The figures computed for the villages studied are not as low as those found in Peru but fall significantly below those realized in the IDRC report. The IDRC report includes bathing and washing hair in its calculations whereas figures mentioned here cover only in-house water. However, only some of the discrepancy with the IDRC report can be attributed to different methodologies used to calculate water use. The remaining water use disparity must be accounted for by the use of less water in the study-area homes for cooking and washing.

Volume of water consumed does not exhibit a simple inverse relationship with distance to a water source. From a study based in East Africa White et al. (1972) found that quantity of water consumption was similar among households so long as the traditional source was less than 1km from the home. Results from this study support that conclusion. Despite lacking household connections volumes of water consumed in Santa Elena, where water sources are within a few hundred metres of the homes, are very similar to those in Yalambojoch and Yulaurel. However, when the women from Yalambojoch were forced to gather water from the Rio Sachilá, a distance of 1-2km from the village, amounts of water gathered were greatly reduced.

5.1.2 Water quality

Microbial, chemical and physical characteristics are the three main properties of concern when supplying a new water source. Feachem (1980a) suggests that moderately good quality water from protected groundwater (Santa Elena) or upland surface sources (Yalambojoch and Yulaurel) may have approximately 100 faecal coliforms/dL. However, since no quantitative water quality studies could be obtained for the villages microbial and chemical properties could not be measured. Comment regarding water quality will be limited to discussion of the physical properties of the water sources. Physical properties are important in determining the acceptability of a source.

Simple qualitative descriptions of the villages' previous water sources have been stated in a profile of each community (CECI a,c,d. unpublished). The previous public taps in Yalambojoch were listed as providing average quality water to the village while water

sources in both Yulaurel and Santa Elena were listed as poor. Criteria for these evaluations is not known and the statements are questionable for those in Yalambojoch secured water from the Rio Sachilá when domestic connections went dry and the previous water source for Yulaurel was not listed. Household connections have provided both Yalambojoch and Yulaurel with water that has physically appealing properties. In both villages the water is clear, cold and odorless. Also the water is not hard nor does it affect the taste of drink. Since the use of filters and chlorination has not been implemented in the village systems, one must consider the quality of the previous sources to determine relative water quality improvements. Water from the Rio Sachilá, with its source on an uninhabited hillside above Yalambojoch, also has many good physical attributes. The river is exceptionally clear with very low turbidity, has a pleasing colour, is very cold and has no foul smell. Those in the village made no negative comments on its taste or hardness when questioned. Hardness was considered as it reflects the chemical quality of the water. High concentrations of calcium and magnesium are the determinants of hard water. Hard water makes it difficult to lather soap for washing. Many studies however suggest that hard water may have beneficial health effects particularly associated with the intake of magnesium (Marier 1979). If water quality improvements have been realized as a result of Yalambojoch's new water source they must be microbial or chemical in nature.

Despite no overt attempt to alter water quality, improvements in quality may still be realized as a result of locating the water-system intake at a spring higher above the village. However, Feachem (1980a) suggests that even well-designed untreated spring supplies will typically contain about 25 faecal coliforms/dL. Since villagers in Yalambojoch

have more domestic animals than those in Yulaurel benefits achieved from gathering water from a higher elevation are more likely to be realized in Yalambojoch. Also, Yalambojoch is the only one of the three villages studied where residents mentioned using chemical fertilizers so again a higher intake may achieve improved water quality. These water quality improvements are only theoretical and can only be verified with a water quality assessment that measures microbial and chemical properties. Nevertheless, any improvements whether real or perceived have not changed the fact that all water for drinking is boiled thoroughly before it is ingested. All the households boiled the water to make coffee or atol (a corn-based drink) and raw water was never taken as a drink with only one exception in Yulaurel. Preparation of staple food items such as beans and nixtamal (for tortillas) require the water to be thoroughly boiled. Only in Yulaurel was there an observance of drinking unboiled water in the form of lemonade. I also drank lemonade and found the water to have a pleasant taste.

Provision of hand pumps in Santa Elena allowed for potential water quality improvements provided the tapped groundwater was clean. Presumably the water is of relatively good quality as the collection basin is small, isolated and without further inhabitants. Water from the tap was clear, cold and had no foul smell. Chemical fertilizers are not used by the villagers and should not pose a pollution problem to the groundwater. Yet improvements of water quality in Santa Elena does not appear to be of tremendous concern to the villagers as 6 of the 14 families have returned to gathering unimproved water from their previous source once the nearby pump became non-functional.

The stream where the water was gathered also has satisfactory physical properties. The water is clear, cold and odorless. Turbidity only becomes a problem after heavy rains but the pool where water is collected settles quickly. Thus it appears that so long as water has satisfactory physical properties there is little incentive to switch to a new improved source. No difference in preparation of the water was noted between households gathering water from the stream versus those gathering from the pump. All households observed thoroughly boiled the water before making coffee.

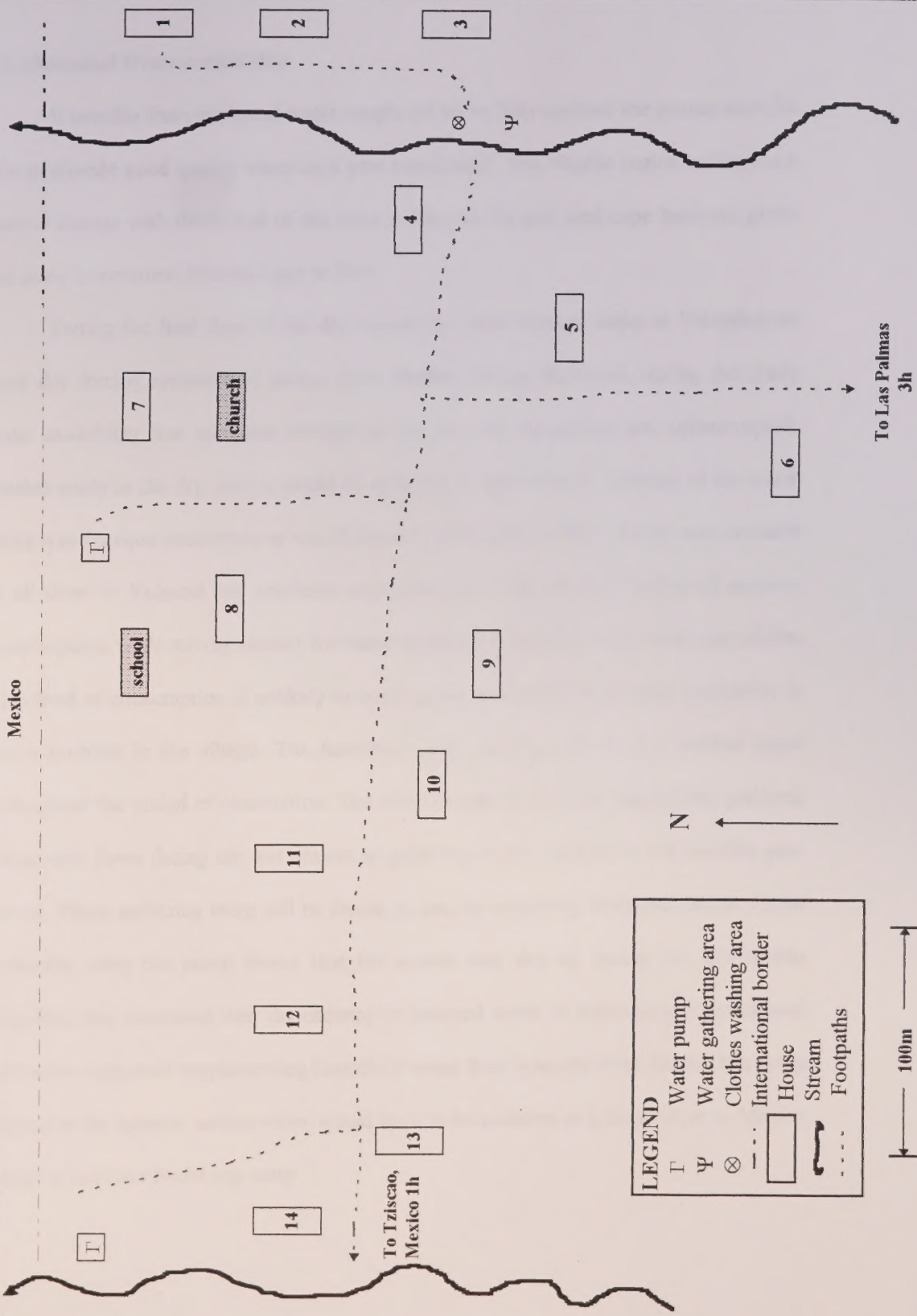
5.1.3 Water accessibility

Making water more accessible can significantly reduce the travel time and energy spent fetching water and this time can be put towards improving domestic conditions, spending increased time with children, income generating activities or relaxation. Since clear divisions exist between labour of men and women improved water accessibility will have a much more profound impact on the lives of the women of the village as they are responsible for collection of water.

When questioned about the benefits of piped water women in Yalambojoch and Yulaurel unanimously stated that the greatest advantage to the new water system was the saving of time and effort in collection. All those interviewed mentioned this as an advantage while just one woman mentioned possible health benefits received from water introduction as an advantage. This response is understandable considering that time savings could be as high as 3 hours per day for Yalambojoch if required to gather water from Rio Sachilá. Water accessibility also seemed to be the overriding factor affecting

location of water gathering in Santa Elena. Those living at the east end of the village (houses 1-4,&7) (figure 7) felt that it was not worth the time nor the effort to gather water from the pump at the west side. Despite the pump being just a 15-20 minute round-trip, over a relatively flat trail, to the most distant house a significant percentage (43%) of the households chose to gather water at the small stream in the village thereby reducing travel time to an average 5 minute round-trip. Savings with respect to water collection time may reach as high as 2 hours (based on 8 tinajas) if water is gathered from the stream.

The map shows the village of Santa Elena with 14 numbered locations. A dashed line represents the international border between Mexico and Guatemala. Key landmarks include a school, a church, a water pump (marked with a psi symbol), and a clothes washing area (marked with a circled cross). Arrows indicate directions to Tziscaco, Mexico 1h and To Las Palmas 3h. A legend defines symbols for water pump, water gathering area, clothes washing area, international border, house, stream, and footpaths. A scale bar indicates 100m.



5.1.4 Seasonal Water availability

If benefits from improved water supply are to be fully realized the source must be able to provide good quality water on a year round basis. The Nentón region undergoes a marked change with the arrival of the rains in May as the arid landscape becomes green and many intermittent streams begin to flow.

During the final days of the dry season the water storage tanks in Yalambojoch went dry forcing residents to gather from another source. However, during the study water availability was adequate throughout the day and the service was uninterrupted. Further study in the dry season would be required to determine if depletion of the water tanks was a unique occurrence or was likely to be a frequent problem. Water was available at all times in Yulaurel and residents mentioned that only during a period of extreme consumption, while mixing cement for construction of the school, was water unavailable. This level of consumption is unlikely to occur again so it seems that water availability is not a problem in the village. The functional pump in Santa Elena also yielded water throughout the period of observation. The stream where many from Santa Elena gathered water only flows during the wet season so gathering at this location is not possible year round. Those gathering there will be forced to use the remaining functional pump. Those presently using the pump feared that the source may dry up during the dry season therefore they decreased their dependence on pumped water by decreasing volumes used and some suggested supplementing household water from a nearby river. Should the pump dry up in the summer season water would have to be gathered at a larger river in Mexico about a half-hour round trip away.

5.2 Latrines

In all three communities the latrine systems were well received and their simple designs have proven to be easy to use and somewhat less problematic than the water systems. All the households interviewed in the villages indicated they exclusively used the latrines for defecating. This would appear to be the case as no incidents to the contrary were noted with adults and latrines are located close to the houses. Also the villages were virtually free of excreta. Villagers had been introduced to the use of latrines while in Mexico stating that latrines were not used prior to their exodus in 1982. When interviewed about the latrines community members almost unanimously mentioned that the villages were much cleaner now than in the past. A few instances of young children defecating in the yard and in open areas within the village limits of Yalambojoch were noted. When pressed a couple of mothers admitted that there are instances when the young children, who find the seat too high, prefer to defecate outside though this does not seem to be a widespread problem. While no occurrences of children defecating in the yard were noted in Yulaurel practices of disposing infants' waste was often inadequate as it was occasionally deposited in the yard within 10m of the house.

In an attempt to ensure 100% latrine coverage for the villages simple standard designs used throughout the developing world were chosen and instituted en masse. The use of these standard designs has resulted in some difficulties with the latrines. In Yalambojoch some of the latrines located at the base of a mountain slope have had the ground crumble beneath the floor resulting in collapse of the base of the latrine so the

Figure 8. Latrine after pit collapse



cement floor can not be used (figure 8). This appears to be a problem with about 5-10 latrines and usually occurs in the rainy season. At present the problem is dealt with by placing logs either directly under the cement seat or under the floor itself. This seems to be successful in maintaining the stability of the floor. Some in the village feel above-ground composting toilets would be more appropriate. Mention was made of this problem also in Yulaurel though no collapse of latrines has occurred. By providing latrines to all residents some overlap has occurred and two houses noted in Yulaurel have both new and old latrines. Most suggested that the cement floor of the new latrines was superior as it does not rot but many were indifferent to the materials used and did not see the new latrines as a great improvement over the old ones.

Latrines in Santa Elena were used by all villagers and most interviewed found the composting latrines to be an effective manner in which to reduce water contamination. Most in the village liked the fact that the latrines were raised and therefore dry. Some men mentioned the women took a while to become accustomed to the urinal though this would never be mentioned by the women themselves. As the composting toilets have only been used since January 1995 the collection tanks have yet to be emptied. Residents of Yalambojoch and Yulaurel stated they never use human waste for fertilizing therefore this may place some doubt as to whether those in Santa Elena will use the waste collected as fertilizer.

In none of the houses visited was commercial toilet paper used despite being available in the village stores. Most commonly used as toilet paper was the children's school notebooks while leaves and corn cobs were also used. Used corn cobs were kept in

the latrines and would most likely be used for fertilizer. An instance of a pop can being thrown into the composting toilets was also noted. These practices reduce the effectiveness of the latrines both in terms of the health benefits received and the possibility of using the waste for compost.

5.3 Hygiene habits

If water and latrines are assumed to aid in the improvement of hygiene the three communities should have improved hygiene as water availability and accessibility is satisfactory and latrines are well used. To ensure that an understanding of proper hygiene was imparted to the villagers instruction was provided in each of the villages by Asociación Ideas, a Guatemalan nongovernmental organization. Instruction began in the initial month of project implementation and was ongoing for a five month period. Courses included discussions on health and sickness, importance of latrines and correct use of water (CECI e. unpublished). Each month three days of courses were conducted with women receiving instruction in the morning, children received instruction at school, and men in the evening when they returned from work in the fields. In Yalambojoch and Yulaurel instruction was translated into Chuj by a member of the local development committee. In theory 100% of the village residents were to receive instruction. When questioned about many of the ideas of the courses, the length of the courses, and who conducted the instruction the responses in Yalambojoch were quite varied. Recall of many of the specifics of the courses seemed to be much stronger in Yulaurel and Santa Elena. This may possibly be attributed to the isolated locations and small sizes of the two

villages. It is less likely that residents would be away from the village and an absentee would be far more conspicuous than in Yalambojoch.

5.3.1 Handwashing

Handwashing is an effective method of interrupting the faecal-oral transmission of pathogens. Gilman (1993) in a study on water availability as a determinant of family hygiene in Peru considered handwashing within 15 minutes of a faecal-contamination event to serve as an intentional interruption of the faecal-oral cycle. Handwashing was anticipated before cooking, before eating and after using the latrine yet handwashing habits, based on the aforementioned criteria, were poor for all villages studied. In the villages handwashing at these times was not strictly adhered to. Handwashing was only regularly undertaken just prior to food consumption. Despite having access to ample quantities of water hands were washed by having a woman of the house pour a cup of water over the person's hands while one rubs them. One cup of water was all that was used per person. Soap was not used in any of the households for handwashing nor was the use of soap offered. Handwashing was very rarely observed prior to cooking nor was it noted after use of the latrines. When working in the fields men were unable to wash their hands as water was unavailable. Breastfeeding is an important method of reducing exposure of pathogens to infants provided no contamination of the breast area occurs. This reduced exposure can be enhanced by the cleaning of hands yet in a very limited sample handwashing was not observed before breastfeeding. Based on the observations in

the communities water availability does not appear to have had a significant positive effect on the handwashing practices of the residents.

Conversations with a teacher, who has been in Yalambojoch prior to the installation of the water system, suggest that improved cleanliness as a result of the new water supply has been minimal. He stated that minor improvements were noted in about 10% of the children but it is difficult to attribute this solely to household water provision. He suggested the cleanliness of the children is dependent on general hygiene conditions of the household.

5.3.2 Water handling

Water handling is important since water can be contaminated in many different stages between collection and consumption. Feachem (1978) has found that faecal coliform counts are often much higher in water from collection jugs than from the water source itself. Thus inadequate water handling practices can render a once clean source polluted. To avoid contaminating water it must be properly stored and not subjected to potential sources of contamination. In these respects water handling in Santa Elena is much superior to that in Yalambojoch and Yulaurel. In Santa Elena water is stored in tinajas inside the house and up off the ground and in all but one household the water jugs were covered. Tinajas were regularly taken to the stream or the pump to be scrubbed with a brush, to remove dirt, and rinsed. The immediate area surrounding the pump was also rinsed and cleaned daily.

In contrast household water in Yalambojoch and Yulaurel was never observed in a covered state nor were any covers noted in the houses. Tinajas were often dirty on the outside and were frequently stored on the ground. Storage on the ground allowed for potential contamination from animals and children near the water jugs. Frequently in these two villages hands were placed in the water jugs to splash and rinse dishes. Occasionally women would eat directly from the food pot with their hands and then handle water. Instances were also noted where hands were placed in the neck of the tinajas, bringing the carriers hand in contact with the water and again increasing the chance of contamination. Fortunately much of the contamination from poor water handling practices is largely mitigated through the boiling of drinking water. This should not mean that there is no cause for concern as the washing of dishes is done using unboiled water and without soap.

5.3.3 Kitchen cleanliness

Cleanliness of the kitchen area is an important aspect of, and can make a positive contribution to, overall household hygiene. Kitchen cleanliness was quite variable among the households and between the communities. Cleanliness seemed to be a higher priority in Santa Elena than in the other villages. Floors were swept everyday in the houses visited but daily sweeping was not carried out in all houses in the two other communities. In Yulaurel food stuffs including tortillas and banana peels remained on the floor for days without being swept up. Plates and cutlery were stored off the ground in all communities and in some homes they were stored in enclosed cupboards. Acceptance of animals in the houses was commonplace in all the communities. Residents of Santa Elena have dogs, cats

and chickens and all on occasion can be found in the houses. Most are chased out quite quickly upon entering with only the cats being allowed to stay permanently. Dogs are not allowed in the kitchens when food is being served. Greater tolerance of animals in the houses was observed in Yalambojoch and Yulaurel. Animals were generally not hurried out and were often in the house when food was consumed. Pigs were the only animals in Yalambojoch that were not tolerated in the house so they were always quickly chased out. Animal presence is noteworthy since cooking platforms in Yalambojoch and Yulaurel are raised just 25-30cm above the ground and animals were occasionally on the platform. Half doors as well as fences proved effective in keeping animals out of the kitchen areas. Garbage disposal consisted of dumping the garbage outside the front of the houses. Those in Santa Elena removed the garbage to an unobtrusive spot whereas the other villages had many houses with garbage, including batteries, metal tins and plastic, within 3m of the kitchen entrance.

Both Gilman (1993) and an IDRC (1995 unpublished) report found that ignorance of hygiene issues was not the reason for noncompliance of proper hygiene habits. Gilman found that 90% of mothers knew that hands contaminated with faecal material could produce disease and that 98% knew that boiled water was better than unboiled water. Likewise, the IDRC report found over 95% of mothers knew that children's diarrhea is preventable. Most respondents (80%) mentioned the importance of handwashing for the child but preventive measures such as boiling water, covering water, keeping animals out and proper disposal of garbage were mentioned by less than one-third of respondents. Findings in this study largely agree with those in the two previous studies. Most women

questioned felt that diarrhea was a result of drinking contaminated water or from eating dirty food. Various persons in the villages were suffering from minor illnesses, including gastro-intestinal illnesses, during my visits. The change in weather conditions, as the rainy season was beginning, was mentioned most often as the reason for illness at this time of the year. Most also mentioned they knew about cholera as they had received instruction about it while living in Mexico. Instruction by Asociación Ideas served to reinforce many of the concepts and teachings the villagers had been exposed to while in Mexico. Knowledge regarding proper hygiene and hygiene practices, did not appear to be related to the technology used to provide water and sanitation services.

5.4 A community-based approach to project implementation and management

Throughout its history as the largest financier of developing country water resource investments, the World Bank has “often encountered implementation, operational and social problems” (Le Moigne et al. 1993:7). The Bank saw achievement goals of its financed water and sanitation projects drop from two-thirds in the late 1970s to one-half by the late 1980s. Only 4 developing countries, the Bank concluded, had reached acceptable levels of public water performance - this over a 23 year period and greater than 120 sector projects (Briscoe 1993). In many instances design of systems was based on experiences from the developed world and though oftentimes the engineering aspects of the water provision systems have been successfully implemented the projects fail for lack of acceptance by the community, inadequate training or technical failures (Okun 1991)(Austin and Jordan 1987). In the mid 1970s in thousands of villages on four

continents 80% of hand pumps installed failed within 3 months to one year due to insufficient maintenance (McNeill 1985). These failures in part lead to a recent policy framework adjustment by the World Bank that now calls for decentralized management to be conducted at the lowest possible level (Le Moigne et al. 1993). In 1992, at the International Conference on Water and Development, 100 countries agreed on lower-level government management. The devolution of decision-making to more local levels of government is intended to lead to greater community involvement and input to determine the proper system for the population.

Community participation in water and sanitation projects can lead to improved designs, reduced costs of construction and operation of the systems and can assist the realization of project benefits. Jenkins-McLean (1991) feels that participation encourages an eagerness to sustain the achievements of the project and Eng et al. (1990) suggest that community participation can also encourage communities to become involved in other development activities that contribute to the social, economic and health well-being. To ensure these benefits can be attained, local villagers must be included in all steps of decision-making. First a true desire must be expressed by the villagers for the project and they must commit funds to the project. These criteria were met as the need for an improved water system was recognized by the residents of Yalambojoch since more refugees would be returning to the village. A request was put forward by community members to UNHCR-CECI to expand the current system to include household connections. Since most villagers had only recently returned from up to ten years in Mexico with very little financial savings CECI required unskilled work in lieu of funds.

The value of this labour was calculated to be Q. 31 533.00 or 22% of the Q. 140 760.00 price of the project (CECI e. unpublished).

Beneficiaries of the project should be consulted and involved in all stages of decision-making to attempt to ensure a successful project. As women are the prime beneficiaries of water supply systems it is only proper to include them in the decision-making process. CECI conducted 4 visits to Yalambojoch to meet with the women of the community. A major problem stated was that the majority of women did not know the representatives on the development committee nor their functions (CECI f. unpublished). This unfamiliarity with the operation of the development committee translated into the women of the community not having a strong voice in decision-making. A CECI report states that the “women [in Yalambojoch] are totally ignored by the men and it is the men who always participate” (CECI a. unpublished). Therefore the women do not want to participate in any meetings. This appeared to be a problem in all the communities but was most acute in Yalambojoch and Yulaurel. While in Yulaurel I was witness to a meeting of the men of the village yet no similar meeting of the women was noted in any community. Roundy (1985) found the exclusion of women in water supply decision-making to be a common problem in development projects worldwide.

Planning and the purchase of materials was done by CECI and Asociacion Ideas while the role of the villagers began with the transportation of materials to the village and continued in an assisting role to masons in the construction effort. Lack of inclusion of village residents in the planning and design stage has lead to some failures and minor shortcomings of the projects. Often improvements through user participation are only of

minor engineering significance but can have a major effect on acceptance of a project. Consultation with members of the development committee probably could have identified the risk of latrine-pit collapse and composting latrines could have been built for some residents. Some residents of Yulaurel stated that the sheet metal roofing was too short on the latrines and rain was able to enter the latrines keeping the interiors very wet. This problem could have been alleviated with only slight extensions of the roof lengths and the problem could likely have been foreseen by the villagers.

Operation and maintenance is often the stage at which projects fail, after large inputs and emphasis on design and construction of the facilities. Many previous water supply and sanitation projects have failed for lack of financial support and utilization of inappropriate technology (Austin and Jordan 1987). Mangin (1989) found that within 5 years of completion 40% of water supply systems studied in Ethiopia no longer produced water, most failing for want of repair.

For its part CECI has conducted instruction on operation and maintenance (O+M) in all villages, chosen simple forms of technology for the projects and established a development committee in each village. The development committees collect a fee of no less than Q. 1.00 per family per month to be put towards the costs of O+M. Feachem (1980b) states that O+M vigilance must be maintained by donor agencies as consultation can not be expected to eliminate all problems and that even after instruction and consultation, O+M can not be entirely conducted by local villagers. The failure of the pump in Santa Elena is a case in point as it was damaged during maintenance and its service is pending a new part.

Consultation is an extremely difficult process in the three communities. While in Mexico the communities were disbanded and residents were often located in different states and therefore they do not have a long history of community participation. Terrorism experienced by the communities tends to destroy solidarity among groups, even among ethnicities, and reduces the opportunity for collective response (Lykes 1994). In Yalambojoch two distinct groups exist, those who have recently returned to the village (within the last 2 years) and formed a group called *Sindicado de Trabajadores en Agricultura* (Council of Agricultural Workers) and those who returned shortly after the exodus and compose the development committee. Both groups have very different priorities for the village so general consensus is difficult to achieve. Paul and Demarest (1984) warn about the difficulties of trying to create a community-wide committee since communities differ in their readiness to act. A community-wide committee may discourage rather than encourage participation and Paul and Demarest recommend working within existing leadership structures. Even on a personal level priorities for further development focus on a wide range of issues from land purchase, to chemical fertilizer supply, to provision of a new molina to grind corn. Yulaurel and Santa Elena do not seem to be communities divided though again different priorities were expressed when discussing village improvements. Consultation presumably was difficult in Yulaurel since previous interactions with a development group that failed to realize projects promised, had left residents wary of future development groups (CECI c. unpublished). Feachem (1980b) feels that community participation is popular because it is something outsiders can

influence but it will not be able to be succeed if national economies and political stance of governments do not allow for the prospects of development.

6. CONCLUSIONS

The improved water supply and sanitation systems have had positive impacts on members of the communities studied. The systems have largely proven to be superior to the previous facilities for gathering water and for sanitation as almost all the populations use the new facilities. Strongest impacts from the improved water supply are in the area of water accessibility. Time (up to 3 hrs. daily) and energy saved gathering water was the benefit most espoused by the women. All the women interviewed cited this as the most important benefit though very few mentioned the possible health impacts associated with improved water provision.

As in many other studies more positive impacts were noted as a result of improving water quantity while potential water quality improvements were largely unnoticed by the communities and did not lead to a change in water consumption practices. All water continues to be boiled before drinking and in food preparation and plain water is never served as a drink. Accessibility of water has also proven to have ramifications in the amount of water consumed. Residents in Yalambojoch showed a significant increase in water consumed when water was able to be gathered at the home versus when they were required to gather water from the river. As long as water remains close to the home, as was the case in Santa Elena, water quantities used in the household were no lower than those in homes with domestic connections.

Availability of water is adequate with the new systems though they are not without supply problems. Only temporary water shortages were noted in the communities but

these were not significant enough nor frequent enough to affect the overall use and loyalty to the new facilities.

Latrines may prove to have a larger role than water supply in the improvement of health conditions in the villages studied. Use of latrines is adhered to and many positive comments were made stating that latrines have assisted in keeping the communities free of excreta and the villages are much cleaner than prior to leaving for Mexico when no latrines existed. Design problems have been encountered in Yalambojoch and Yulaurel leading to collapse of some latrines while others are unpleasant to use in inclement weather. Universal coverage of latrines in the villages has on occasion led to duplication of services in some homes and those with prior latrines were indifferent as to the benefits of the new facilities.

Despite general acceptance and use of the new water supply and sanitation facilities hygiene habits appear to be largely unchanged and inadequate to achieve wide-scale health improvements. Handwashing is mainly limited to prior to food consumption and is done in a manner that is unlikely to clean the hands of pathogens. Washing of hands was rarely noted before food preparation and after the use of latrines. Similarly the handling of water still poses the possibility of contamination. Uncovered water was often stored within reach of children and animals and hands were often placed within the water jugs. Collection containers were often dirty therefore water storage and handling practices can serve to negate the positive effects from increased water quantity and improved quality. Acceptance of animals in the house is likely to go unchanged but serves again as a potential health risk.

As a bridge between emergency assistance and a “classic” development project the difficult task of community participation has been handled well by CECI. Community residents have been actively involved in most stages of the project development from contribution to the effort to the sharing of the benefits, though participation by women remains weak. One shortcoming has been the lack of input from the villagers on the design of the facilities. This has led to minor failures and inconveniences of the latrines and weaknesses in the vigilance of operation and maintenance has rendered one pump in Santa Elena temporarily out of service. Community participation and education can only partially serve the people and it will take an efficient system of government that reaches to the community level to allow full development to be realized.

In light of the shortcomings of projects undertaken during the International Drinking Water Supply and Sanitation Decade it is unrealistic to expect eradication of poverty, economic growth and a raised standard of living all to occur through the new systems of water supply and latrines provided in the communities studied. The view that variables such as water supply and sanitation are singular “keys” to economic and social development is simplistic and results from projects will be disappointing if broad-based development is the anticipated goal. Development projects undertaken in poor isolated communities must often stand on their own without complimentary services and continued support from development organizations and governments. Therefore, the limits of self reliance also serve as limiting factors in the development of the communities. The political and social history, physical isolation, and distance from larger service centers exacerbate the difficulties development faces in this region. The projects in the communities studied

have had some positive effects on village residents but alone will not be the solution to development. Without massive infrastructure inputs, which would change the nature of the communities they are intending to assist, and radical social changes complete “development” is an unattainable goal.

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